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NATIONAL AERONAUTICS
AND SPACE ADMINISTRATION

NASA-15106 (October 2003)
NASA
Superseding NASA-15106
(March 2003)

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DIVISION 15 - MECHANICAL

SECTION 15106

FERROUS PIPE AND FITTINGS

10/03

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SECTION 15106

FERROUS PIPE AND FITTINGS
10/03

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NOTE: Delete, revise, or add to the text in this section to cover project requirements. Notes are for designer information and will not appear in the final project specification.

This section covers steam and condensate systems (150 and 350 pounds per square inch (psi)) (1034 and 2413 kilopascal) and high-pressure compressed air systems(2,000 and 6,000 psi) (15 and 41 megapascal). For other types of steel pipe and valves, see Section 15050 BASIC MECHANICAL MATERIALS AND METHODS and Section 15110 VALVES.

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PART 1 GENERAL

1.1 REFERENCES

****

NOTE: The following references should not be manually edited except to add new references. References not used in the text will automatically be deleted from this section of the project specification.

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The publications listed below form a part of this section to the extent referenced:

ASME INTERNATIONAL (ASME)

ASME B16.11-2001	(1996) Forged Steel Fittings, Socket-Welding and Threaded
ASME B16.3	(1998) Malleable Iron Threaded Fittings Classes 150 and 300
ASME B16.39	(1998) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300

ASME B16.5	(1996) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B18.2.2	(1987; R 1993) Square and Hex Nuts (Inch Series)
ASME B18.2.4.6M	(1981; R 1990) Metric Heavy Hex Nuts
ASME B36.10M	(2000) Welded and Seamless Wrought Steel Pipe

ASTM INTERNATIONAL (ASTM)

ASTM A 105/A 105M	(2001) Standard Specification for Carbon Steel Forgings for Piping Applications
ASTM A 106	(1999 e1) Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A 181/A 181M	(1995; Rev B) Standard Specification for Forgings, Carbon Steel, for General-Purpose Piping
ASTM A 193/A 193M	(1997; Rev A) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 194/A 194M	(1997) Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
ASTM A 197/A 197M	(2000) Standard Specification for Cupola Malleable Iron
ASTM A 234/A 234M	(2000) Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperatures
ASTM A 325	(2000) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 325M	(2000) Standard Specification for High Strength Bolts for Structural Steel Joints (Metric)
ASTM A 53	(1999; Rev B) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

ASTM F 104 (1995) Standard Classification System for Nonmetallic Gasket Materials

1.2 SUBMITTALS

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NOTE: Review submittal description (SD) definitions in Section 01330 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control. Include a columnar list of appropriate products and tests beneath each submittal description.
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The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

Installation Drawings for steel piping shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

SD-07 Certificates

Certificates shall be submitted for the following items showing conformance with the referenced standards contained in this section.

Piping for Steam and Condensate
Piping for High-Pressure Compressed-Air Systems
Fittings
Unions
Flanges
Gaskets
Bolting

1.3 GENERAL REQUIREMENTS

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NOTE: If Section 15003 GENERAL MECHANICAL PROVISIONS is not included in the project specification, applicable requirements therefrom should be inserted and the following paragraph deleted.
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Section 15003 GENERAL MECHANICAL PROVISIONS applies to work specified in this section.

Installation Drawings for steel piping shall be in accordance with the manufacturer's recommendations and in accordance with Section 15050 BASIC MECHANICAL MATERIALS AND METHODS.

PART 2 PRODUCTS

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NOTE: For accessories and supporting elements see Section 15050 BASIC MECHANICAL MATERIALS AND METHODS.
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2.1 PIPING FOR STEAM AND CONDENSATE

Steam and condensate piping for 150-, 350-, 2,000-, and 6,000-pound per square inch (psi) 1034-, 2413-, 13790-, 41369- kilopascal service shall be black carbon steel (BCS).

2.1.1 Type BCS-150 (150-psi1034 kilopascal Service)

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NOTE: Avoid screwed-end connections in condensate piping wherever possible. Bend pipe for change in direction where practicable.
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Pipe or tube (1/8 inch through 10 inches): (DN6 through DN25): Schedule 40 for steam, Schedule 80 for condensate, seamless black carbon steel, conforming to ASTM A 106, Grade B and ASME B36.10M

****
NOTE: Select 150- or 300-psi 1034 or 2068 kilopascal malleable-iron or forged-steel fittings; delete fittings not applicable if option is not given.
****

Fittings (1/8 inch through 2 inches): 300-psi (DN6 through DN50): 2068 kilopascal working steam pressure (wsp) banded malleable iron, screwed end, conforming to ASTM A 197/A 197M and ASME B16.3

Fittings (1/8 inch through 2 inches): 2,000-or 3,000-psi (DN6 through DN50): 15- or 20- megapascal water, oil, or gas (wog) forged carbon steel, socket weld or screwed end, conforming to ASTM A 105/A 105M and ASME B16.11-2001

Fittings (2-1/2 through 10 inches): (DN65 through DN250): Wall thickness to match pipe, long radius, butt weld, black carbon steel, conforming to ASTM A 234/A 234M, Grade WPB, and ASME B16.9

****
NOTE: Select 250-psi 1724 kilopascal malleable iron or forged steel unions.
****

Unions (1/8 inch through 2 inches): 250-psi (DN6 through DN50): 1724

kilopascal wsp, malleable iron, screwed end, ground joint, with brass or bronze seat insert, conforming to ASME B16.39

Unions (1/8 inch through 2 inches): 2,000 or 3,000-psi (DN6 through DN50): 15- or 20- megapascal wog, forged carbon steel; socket weld through 2-inch 50 millimeter, screwed end through 1-inch 25 millimeter, conforming to ASTM A 105/A 105M and ASME B16.11-2001, with ground joint and stainless-steel seat insert

Flanges (2-1/2 through 10 inches): 150-pound (DN65 through DN250): 1034-kilopascal, forged carbon steel, welding neck, with raised face or flat face and concentric finish, conforming to ASTM A 105/A 105M and ASME B16.5

Flange Gaskets: Compressed non-asbestos sheet conforming to ASTM F 104, Type 1, P1161A, coated on both sides with graphite or similar lubricant, containing not less than 75-percent non-asbestos fiber materials

Bolting: Bolting and flange bolting shall be hexhead and shall conform to ASTM A 325 ASTM A 325M. Heavy hex-nuts shall conform to ASME B18.2.2. ASME B18.2.4.6M. Square-head bolts and nuts are not acceptable.

2.1.2 Type BCS-350 (350-psi 2413 kilopascal Service)

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NOTE: Avoid screwed-end connections in condensate piping wherever possible. Bend pipe for change in direction, where practicable.

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Pipe or tube (1/8 inch through 10 inches): (DN6 through DN25): Schedule 40 for steam, Schedule 80 for condensate; seamless black carbon steel, conforming to ASTM A 106, Grade B and ASME B36.10M

Fittings (1/8 inch through 2 inches): 2,000-or 3,000-psi(DN6 through DN50): 15- or 20- megapascal wog to match pipe wall, forged carbon steel, socket weld or screwed end, conforming to ASTM A 105/A 105M and ASME B16.11-2001

Fittings (1/8 inch through 10 inches): (DN6 through DN25): Schedule 40, long-radius, butt weld, black carbon steel, conforming to ASTM A 234/A 234M, Grade WPB, and ASME B16.9

Unions (1/8 inch through 2 inches): 2,000-or 3,000-psi(DN6 through DN50): 15- or 20- megapascal wog to match pipe wall, forged carbon steel, socket weld through 2-inch 50 millimeter, screwed end through 1-inch 25 millimeter, conforming to ASTM A 105/A 105M and ASME B16.11-2001, with ground joint and stainless-steel seat insert

Flanges (2-1/2 through 10 inches): 300-pound (DN65 through DN250): 2068 kilopascal, forged carbon steel, weld neck, with raised face and concentric serrated finish, conforming to ASTM A 181/A 181M, Class 70, and ASME B16.5

Gaskets: Spiral-wound, non-asbestos-fiber-filled, carbon steel, with

centering provisions, conforming to ASME B16.5, Group 1

Bolting: Heavy hex-head, carbon-steel bolts or bolt studs and semifinished heavy hexnuts, conforming to ASTM A 325 ASTM A 325M.

Square-head bolts are not acceptable.

2.2 PIPING FOR HIGH-PRESSURE COMPRESSED-AIR SYSTEMS

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NOTE: ASME B31.1 Does not cover industrial compressed air piping outside of power houses. ANSI B31.2 covers only fuel gas portion of obsolete industrial gas and air piping systems. ANSI committee recommends interim use of ASME B31.3 for compressed-air piping.

The following system pressures are based on ASME B31.3, zero corrosion factor, welded joints, and a stress value of 20,000 psi 138 megapascal systems with pipe size larger than 3 inches 80 millimeter.

The following material specifications do not take into account material temperatures lower than minus 20 degrees Fminus 7 degrees C.

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2.2.1 Type BCS-2,000 (2,000-psi 15 megapascal Service)

Pipe or tube (1/8 inch through 3 inches): (DN6 through DN80): Schedule 40, seamless black carbon steel, conforming to ASTM A 106, Grade B, or ASTM A 53, Grade B, Type S, and ASME B36.10M

Fittings (1/8 inch through 1-1/2 inches): 2,000-psi (DN6 through DN40): 15 megapascal wog, forged carbon steel, socket weld, conforming to ASTM A 105/A 105M and ASME B16.11-2001

Fittings (2 through 3 inches): (DN50 through DN80): Schedule 40, long radius, butt weld, black carbon steel, conforming to ASTM A 234/A 234M, Grade WPB, and ASME B16.9

Flanges (1 inch through 3 inches): 900-pound (DN25 through DN80): 6200 kilopascal, forged carbon steel, welding neck, with raised face and concentric serrated finish, conforming to ASTM A 105/A 105M or ASTM A 181/A 181M, Class 60, and ASME B16.5

Gaskets: Spiral wound, non-asbestos-fiber-filled, carbon steel, with centering provisions, conforming to ASME B16.5, Group 1

Bolting: Alloy-steel bolt studs conforming to ASTM A 193/A 193M, Grade B7, and semifinished heavy hex-nuts, conforming to ASTM A 194/A 194M, Grade 2H

2.2.2 Type BCS-6,000 (6,000-psi 41368-kilopascal Service)

Pipe or tube (1/2 inch through 3 inches): (DN15 through DN80): XXS, seamless, black carbon steel, conforming to ASTM A 106, Grade B, or ASTM A 53, Grade B, Type S and ASME B36.10M

Fittings (1/2 inch through 1-1/2 inches): 6,000-psi (DN15 through DN40): 41.3 megapascal wog, forged carbon steel, socket weld, conforming to ASTM A 105/A 105M and ASME B16.11-2001

Fittings (2 through 3 inches): (DN50 through DN80): XXS, long-radius, butt weld, black carbon steel, conforming to ASTM A 234/A 234M, Grade WPB, ASME B16.9, and ASME B36.10M

Flanges (2 through 3 inches): 2,500-pound (DN50 through DN80): 17.2 megapascal, forged carbon steel, welding neck with raised face and concentric serrated finish, conforming to ASTM A 105/A 105M and ASME B16.5

Gaskets: Spiral-wound, non-asbestos-filled, carbon steel, with centering provisions, conforming to ASME B16.5, Group 1

Bolting: Alloy steel bolt studs conforming to ASTM A 193/A 193M, Grade B7, and semifinished heavy hex-nuts, conforming to ASTM A 194/A 194M, Grade 2H

PART 3 EXECUTION

3.1 GENERAL

Pipe shall be installed in accordance with manufacturer's recommendations and in accordance with Section 15050 BASIC MECHANICAL MATERIALS AND METHODS.

-- End of Section --